REMARKS

Introduction

The applicant appreciates the careful review of the application that the Examiner has conducted. We enclose herein proposed amendments and submissions in response to all objections and rejections raised in the Office Action.

In general terms, the claim amendments better highlight the applicant's success in overcoming challenges in bending thin-walled, stainless steel tubing having a polygonal cross-section. The applicant submits that motor vehicle radiator grilles of the sort taught in the present application were not manufactured previously because of the manufacturing challenges presented. As discussed in the ***Background of the Invention***,

> "**[0009]** ... Unfortunately, stainless steel is more difficult to bend through curves than aluminum and is too heavy and expensive to use in solid bars. When a stainless steel tubular bar is bent, there is a tendency for its sidewalls to buckle either inward or outward, weakening the bar and ruining its appearance. For this reason, stainless steel slats currently available in the marketplace tend to be formed as small-diameter cylindrical tubes that better resist such bending-induced buckling than do prismical tubes with their sharp edges. However, it seems that the marketplace has rejected these cylindrical slats because they don't produce the desired appearance; their whole circumference is uniformly polished, no part is coated black, and they are not deeper than they are thick.
>
> **[0010]** Accordingly, there is a need for a way to manufacture a stainless steel prismical tube that can be bent through curves along its longitudinal axis to form the desired slat, but without buckling the sidewalls."

The ***Design for Manufacturability Handbook*** describes some of the challenges in manufacturing with stainless steel as compared to other materials,

> "Stainless steels are generally selected, first, on the basis of corrosion resistance and, second, on the basis of strength or other mechanical properties. In some applications, end-use requirements may be so restrictive as to preclude a third-level consideration: fabricability. The production engineer, however, should keep in mind that many of the stainless steels, especially those in the 200 and 300 series, have fabrication characteristics different from those of carbon steels. For example, more force is required in the tools used to bend, draw, and cut, and slower cutting speeds and different tool geometries are required for machining.[1]

Detailed Remarks

- ***Claim Objections - 37 CFR §1.75(c): Multiple Dependence***

The Office Action objects to claims 23-42 for multiple dependency from multiply-dependent claims.

By this Amendment, claims 31, 33, 34 and 39 have been cancelled and claims 23-28, 30, 32, and 35-42 have been amended to state their additional limitations explicitly instead of by reference to preceding claims.

The applicant therefore respectfully requests that this objection be withdrawn.

- ***Claim Objections: Typographical Error***

The Office Action objects to a typographical error in claim 1 and suggests insertion of the word "of".

By this Amendment, claim 1 has been so amended.

The applicant therefore respectfully requests that this objection be withdrawn.

[1] Bralla, James G.. ***Design for Manufacturability Handbook***, Second Edition. New York: McGraw-Hill, 1999. (ISBN 007007139X / LOC TS176.H337) at *Part 3: Stainless Steel*, page 2.33.

☐ *Claim Rejections - 35 USC § 112: Indefiniteness*

The Office Action rejects claims 22-42 as being indefinite on the grounds that an apparatus claim cannot depend from a method claim because the scope of the claim cannot be determined.

The applicant submits that remaining pending claims 22-28, 30, 32, and 35-42 are product-by-process claims and therefore not indefinite. As stated above in the introductory remarks, the applicant submits that products of this sort were not commercially manufactured prior to the invention of the process taught in the present application.

The applicant therefore respectfully requests that this rejection be withdrawn.

☐ *Claim Rejections - 35 USC § 102: Anticipation: US5,555,762 (Kuramura)*

The Office Action rejects claims 1-6, 9-12 and 22-42 as being anticipated by Kuramura.

Kuramura teaches that better results can be achieved in bending a tube by inserting certain fats into the tube before bending and then removing the fat afterward.

Although Kuramura makes passing reference in the ***Description of Related Art*** to reinforcing cores other than fats, such references are non-enabling and in fact teach away from the present invention. For example, Kuramura suggests that others have used a sand core, unsuccessfully, to reinforce the narrow space between concentric pipes (C1, L31-37) and small-diameter single pipe (C1, L60-67), but not to reinforce larger-diameter single pipe. Kuramura suggests that others have used a string of metallic beads to reinforce larger-diameter single pipe.

Kuramura does not discuss the use of a liquid reinforcing core. He discusses only the use of a solid core that is inserted into the tube and subsequently removed from the tube in its liquid state.

Kuramura does not discuss stainless steel fabrication whatsoever. His main example focuses on bending a carbon steel double pipe (C4, L19).

Kuramura mentions in passing that,

> "Further, good results can also be obtained by filling the above described filling material into the metallic pipe when a single layer metallic pipe such as a square pipe, a small-diameter pipe or the like is subjected to a bending work" (C6, L31-34)

but does not provide further teaching on these aspects, in contrast to the more detailed experimental results provided for his main example. In fact, in his main example, Kuramura uses a "core metal 5" mandrel (Figures 1(a), 1(b), C3 L11, C3 L25-29) and not fat to reinforce the larger internal diameter of pipe P2. Furthermore, although Kuramura makes the above passing reference to "square pipe", he offers no teaching whatsoever regarding pipes having less symmetric or less regular polygonal cross-sections, which can present additional challenges and considerations during bending.

Kuramura's teaching thus focuses on reinforcing small volumes either within or concentrically between pipes having highly symmetrical cross-sections, for example circular or square.

By this amendment, claims 4, 6, 10, 12, 25, 27, 28, 31, 33, 34 and 39 have been cancelled. Claim 1 has been amended to highlight the teaching of the present invention relating to bending a thin-walled, stainless steel tube having polygonal cross-section through a desired

curvature by reinforcing a portion of the tube with a core comprising at least one of: granules, liquid, and a sprung mechanism that inscribes the portion. All other pending claims depend directly or indirectly from claim 1.

The applicant therefore respectfully requests that this rejection be withdrawn.

- ☐ *Claim Rejections – 35 USC § 103: Obviousness*
  - ☐ *Kuramura in View of US3,343,250 (Berto)*

The Office Action rejects claims 7-8 as being rendered obvious by Kuramura in view of Berto.

Berto teaches that better results can be achieve in bending a multiple tube (e.g. two or more concentric tubes) by inserting polyethylene glycol into the space between adjacent tubes before bending and then removing the polyethylene glycol afterward.

Although Berto makes passing reference, in describing the related art, to "an insert in the form of a spring support and the like to prevent crushing or deformation of the tubular material during the bending operation" (C1, L25-28), this reference is non-enabling and in fact teaches away from the present invention as being inferior to the Berto invention.

In particular Berto does not teach the use of a sprung mechanism that inscribes the portion of the tube that is being reinforced for bending, nor does he teach the use of a coil spring that has an outside perimeter substantially congruent with the inside perimeter of that portion.

By this amendment, claim 7 has been canceled and claims 1 and 8 have been amended to better highlight the teaching of the present invention relating to the use of a sprung mechanism that inscribes the portion of the tube that is being reinforced for bending and the use of a coil

spring that has an outside perimeter substantially congruent with the inside perimeter of that portion.

The applicant therefore respectfully requests that this rejection be withdrawn.

- *Kuramura in View of US6,883,552 (Ooyauchi)*

The Office Action rejects claims 13-16 as being rendered obvious by Kuramura in view of Ooyauchi.

Ooyauchi teaches a way to fabricate a flat sheet of stainless steel into a small-diameter tube as a stage in producing a pin or an injection needle (C1, L16), focusing on "Metal tubes of small diameter such as those having, for example, an outer diameter of up to 2mm" (C1, L14-15).

Ooyauchi is nonanalogous art. Ooyauchi provides no teaching whatsoever on how to bend a tube; the teaching is restricted to fabrication of a tube from a planar blank. Furthermore, this teaching is directed to especially small-scale fabrication of items like pins and injection needles, which are nonanalogous to radiator grilles for motor vehicles. There is absolutely no motivation or suggestion to combine the differently directed teachings of Kuramura and Ooyauchi.

The applicant therefore respectfully requests that this rejection be withdrawn.

- *Kuramura in View of US6,189,354 (Spath)*

The Office Action rejects claims 17-21 as being rendered obvious by Kuramura in view of Spath.

Spath teaches the use of a configurable multistation device for folding profiles, having interchangeable modules that can be mounted and adjusted on a common machine body to provide quick adaptation to folding requirements. (Paraphrasing the Abstract)

Although Spath teaches the use of opposing rollers in this regard, he does not teach a roller configuration that produces a channel substantially congruent with the outside perimeter of a work piece or that provides the consequent benefits, as does the present invention.

Spath's figures teach a relatively open bending path, not a substantially closed channel congruent with the outside perimeter of a work piece. Spath provides no teaching on squaring, untwisting or straightening, (or deskewing, flattening, unbowing, righting, aligning, etc.) as does the present invention. Furthermore in this regard, Spath does not appear to present a roller configuration having a straight path for squaring or untwisting a tube without unbending it.

By this amendment, claims 18 and 21 have been cancelled and claim 17 has been amended to highlight the teaching of the present invention relating to the configuration of the rollers to define a channel that is substantially congruent with the outside perimeter of the portion being worked.

The applicant therefore respectfully requests that this rejection be withdrawn.

Conclusion

The applicant believes that the amendments proposed and the submissions advanced overcome all of the rejections and objections raised in the Office Action.

In view of these amendments and submissions, favorable consideration and allowance of the application are respectfully requested.

Respectfully submitted,

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